CASE REPORT

Orascopic visualization technique for conventional and surgical endodontics

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Abstract

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Aim To present a technique of integrating fibre optic orascope and rod-lens endoscope for visualization in conventional and surgical endodontic treatments.

Summary Innovative advancements in fibre optic and rod-lens endoscope technology have allowed for the development and evolution of orascopic endodontics. The use of orascopy in conventional and surgical endodontic treatments has enabled the endodontist to become more discerning about the endodontic aetiology and the treatment procedures.

Key learning points

- Orascopy is a procedure that uses an orascope or a rod-lens endoscope for visualization in the oral cavity.
- An orascope is made up of fibre optics and an endoscope is made up of glass rods.
- Orascopic endodontics is the use of orascopy for visualization in conventional or surgical endodontic treatment.
- A 0.8 mm lens diameter, 0°, 10K fibre optic orascope and a 4 mm lens diameter, 30°, 4 cm rod-lens endoscope are used for visualization in conventional endodontics.
- The 2.7 mm lens diameter, 70°, 3 cm long rod-lens endoscope is used for visualization in surgical endodontics.

Keywords: fibre optic orascope, orascopic endodontics, rod-lens endoscope.

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Introduction

Orascopy is a procedure that uses an orascope or rod-lens endoscope for visualization in the oral cavity (Bahcall & Barss 1999a). Orascopic endodontics is the use of orascopy for visualization in the conventional or surgical endodontic treatment (Bahcall & Barss 1999b). The difference between an orascope and an endoscope is that an orascope is made up of fibre optics (Fig. 1) and an endoscope (Fig. 2) is made up of glass rods. Both the orascope and the endoscope work in conjunction with a camera, light source and a monitor (Fig. 3).

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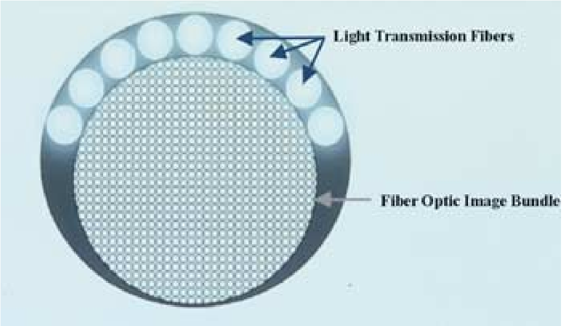

Figure 1 Diagram of fibre optics.

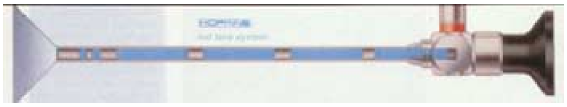

Figure 2 Diagram of glass rod-lens.

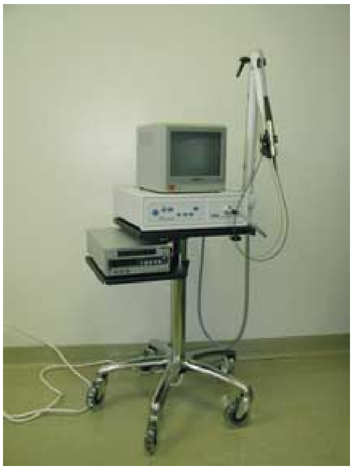

Figure 3 The orascopic visual system (Jedmed, St. Louis, MO).

The option of a printer or a digital recorder can be added to the system for documentation of the procedure.

Rod-lens endoscope

The use of a rod-lens endoscope in endodontics was first reported in the literature in 1979 (Detsch *et al.* 1979). It was used to help in diagnosing dental fractures. In 1996, the use of rod-lens endoscope was reported for conventional and surgical endodontic visual applications (Held *et al.* 1996, Shulman & Leung 1996). It was recommended to use an endoscope that was 6 cm in length and had a 4.0 mm diameter lens with a 30° angle for surgical endodontics (Bahcall *et al.* 1999). Since this time, technological advancements have enabled the development of smaller endoscopes with increased angulation. Prior to these

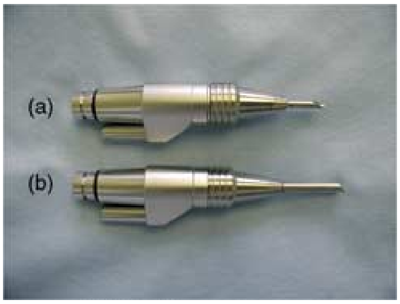

Figure 4 (a) 2.7 mm tip diameter, 70°, 3 cm rod-lens endoscope. (b) 4 mm tip diameter, 30°, 4 cm length rod-lens endoscope.

newer scopes, short scopes were too fragile, and an increased angulation beyond 30° caused a fish-eye effect (a rounded appearance) of the image. The present endoscopes can be manufactured shorter and without any fish-eye effect when the lens is angled beyond 30°. A 2.7 mm lens diameter, 70° angulation, 3 cm long rod-lens is used for surgical endodontic visualization, and the rod-lens endoscope used for conventional endodontic visualization has a 4 mm lens diameter, 30° angulation and is 4 cm in length (Fig. 4a,b).

The rod-lens endoscope allows clinicians greater magnification, greater clarity as compared to the microscope and the loupes and a nonfixed field of vision. Nonfixed field of vision is the ability to view a treatment field at various angles and distances without losing the depth of the field and the focus (Bahcall & Barss 2001b). This is a major advantage over the use of the microscope for endodontic treatment visualization.

The physical optics of a microscope is similar to that of a magnifying glass. As the central object in a treatment field becomes more magnified, the perimeter of the field of view becomes out of focus, and the overall depth of the field becomes limited. Therefore, at high magnifications, any movement of the microscope or the patient will cause the treatment field to become out of focus. This is the reason the microscope cannot view a treatment field from various vantage points. It must remain in what is referred to as a fixed field of vision in order to be an effective visualization instrument in conventional and surgical endodontic treatments.

Fibre optic orascope

Limited intracanal visualization in endodontics was the catalyst for fibre optic development and usage (Bahcall & Barss 2001a). In the past, fibre optic imaging provided superior ergonomics, but suffered from poor image quality. Today, a unique lens design combined with a digital image processing system in the camera allows fibre optics to be on par with the image quality of the endoscope. Fibre optics are made of glass or plastic. The advantages of fibre optics in endodontics are significant. They are small, lightweight and very flexible. This allows for easy manipulation of a nonfixed field of vision within an endodontic treatment field. It is important to note that the image quality from fibre optic usage has a direct correlation to the number of fibres and the size of the lens used in an orascope.

The fibre optic scope used for intracanal visualization has a 0.8 mm tip diameter, 0° lens and the working portion is 15 mm in length (Fig. 5). The orascope has 10 000 parallel visual fibres. Each visual fibre is between 3.7 and 5.0 μ in diameter. A ring of much larger light transmitting fibres surrounds the visual fibres for illumination of the treatment field.

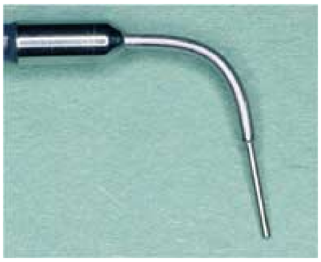

Figure 5 0.8 mm tip diameter, 0°, 10K fibre orascope.

General orascopic visualization technique

Orascopic endodontics requires that the endodontists become critical of the way visualization in conventional or surgical endodontics is performed. Unlike the treatment fields in conjunction with loupes or a microscope, the orascope or endoscope is in much closer proximity to the field of treatment. This close proximity of the treatment environment can enable factors like blood and condensation to effect the clarity of the image. The actual orascope or endoscope usage during conventional or surgical treatment is minimal. It is used when specific magnification (Bahcall & Barss 2000) is needed. Specific magnification is defined as the use of high-power magnification with a good depth of field for critical evaluation of a treatment field.

It is recommended to use 2–2.5× loupes for visualization prior to the use of the orascope or the endoscope (Bahcall *et al.* 1999). Loupes should be used in the conventional endodontic treatment to access canals and in the surgical endodontic treatment to reflect gingival tissue, remove cortical and medullary bone and isolate the root end. The endodontist holds the orascope or endoscope during the treatment (Bahcall *et al.* 1999). This helps in maintaining good eye–hand coordination during examination or treatment. The clinician and the assistant(s) view the image from the monitor (Fig. 6). The camera has a digital zoom that allows enhanced magnification of a treatment field. A personal LCD monitor (Sony Corp, NY, USA) allows the clinician to view the treatment field without looking at the monitor (Fig. 7). Although there is a slight loss of image clarity, the personal LCD improves the working ergonomics. The endodontist can maintain his or her head and body position and needs only to move his/her eyes in the upward direction to view the image from the glasses. Additionally, the open design of the LCD personal monitor allows the clinician to view the actual field of treatment by simply looking under the lower border of the glasses.

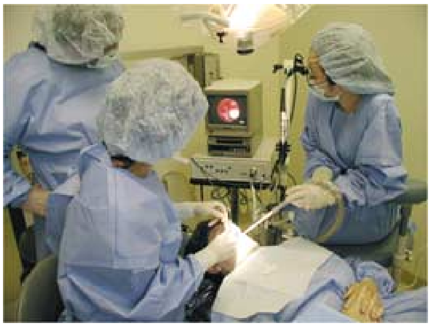

Figure 6 Endodontist viewing the image from the monitor.

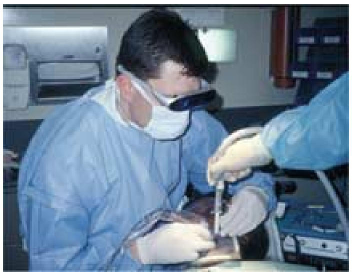

Figure 7 Endodontist viewing the image from the personal LCD monitor.

Orascopic visualization technique in conventional endodontic treatment

Once the pulp chamber has been cleaned of the soft tissue, the 4 mm lens diameter, 30° endoscope can be used to examine the pulpal floor, when it is necessary for the clinician to have a higher magnification during the conventional endodontic treatment. The clinician holds the endoscope instead of the dental mirror when using instrumentation or during examination of a conventional endodontic field. When using an instrument or handpiece in conjunction with the endoscope, it is recommended to stabilize the scope by resting it on a cusp tip. If this is not possible because of the tooth morphology, a high-speed bur can be used to create a rest in the enamel.

The 0.8 mm orascope is used to visualize within a canal system (Fig. 8). Prior to the placement of the 0.8 mm fibre optic scope, the canal must be prepared to a size #90 in its coronal 15 mm. If the canal is underinstrumented, a wedging of the probe may damage some of the fibre optic bundles within the scope. It also allows the full 15 mm of the scope to penetrate within the canal. The focus and depth of the field is 0–infinity. This allows the orascope to provide imaging of the apical-third of the root without actually having to be placed in this region of the canal.

The canal must be dried prior to the usage of the 0.8 mm scope. Although the scope will see through sodium hypochlorite, this solution has a high light-refractory index. This will cause greater amounts of light to be reflected, thus making it difficult to see details of the canal.

An intracanal instrument was developed to enable the endodontist to remove a separated instrument, identify a fracture or remove other debris obstructions (Fig. 9). When intracanal instruments are used, the 0.8 mm scope is backed out enough from the canal to allow the passage of the instrument around it. When the instrument is in place, the

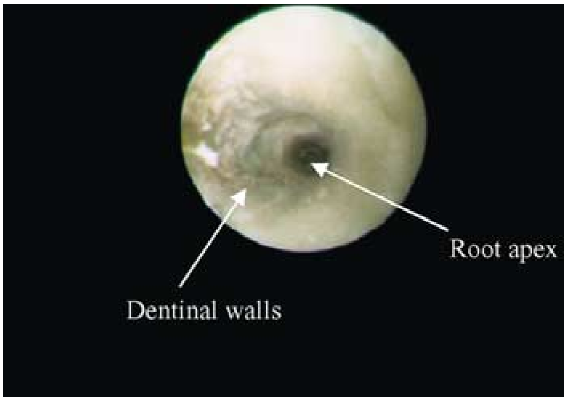

Figure 8 *In vivo* image of intracanal visualization with a 0.8 mm orascope.

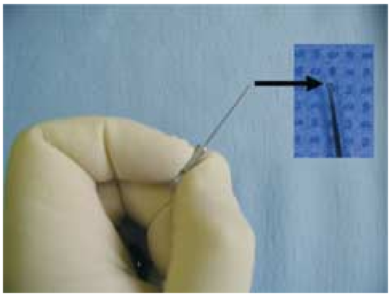

Figure 9 Intracanal instrument.

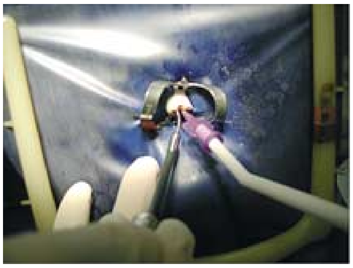

Figure 10 Placement of the 0.8 mm orascope in conjunction with the microsuction.

endodontist can view the canal from the monitor, whilst engaging the instrument in the canal.

Conventional orascopic endodontic usage of fibre optics in the pulp chamber or intracanal region has demonstrated that the environment is very warm and humid. Temperature and humidity difference between the dental operatory and the canal can cause moisture to condense on the scope's lenses. This results in fogging of the lenses. The use of a microsuction (Ultradent, South Jordan, Utah) eliminates this fogging effect on the lens (Fig. 10).

Orascopic visualization technique in surgical endodontic treatment

The 2.7 mm lens diameter, 70°, 3 cm length rod-lens endoscope is recommended for visualization of the surgical endodontic procedures. Prior to placement of a scope, haemostasis of the surgical field must be obtained. The scopes will not provide a discernible image when placed in blood. The warm blood will also create condensation on the lens. If this occurs, the metal microsuction (larger diameter than used for intracanal visualization) is used to remove this fogging effect. Also, methylene blue should be used in conjunction with visualization instruments to help in identifying the aetiology (Cambruzzi 1985). As in conventional endodontic scope application, the endodontist should hold the endoscope, whilst the assistant retracts the gingival tissue and suctions during the surgical treatment.

The 70° angle enables the scope to provide imaging of the resected root end(s). The endoscope should be stabilized on the bone in such a manner that the operator can get a clear image of the root end. It is not recommended to use the endoscope to also retract the gingival tissues. This will not allow free movement of the scope without getting the gingival tissue or bleeding in the line of sight.

It is important to note that the orascope and the endoscope will allow the endodontist to visualize not only the aetiology, but also the removal of this aetiology via ultrasonic instrumentation.

Documentation of procedures

The recent advancements in digital recorders have allowed high-quality digital taping of endodontic procedures that are viewed with an orascope or an endoscope. This digital recording shows little degradation and allows high-quality still images to be selectively printed from a digital printer.

Conclusion

Innovative advancements in fibre optic and rod-lens endoscope technologies have allowed for the development and evolution of orascopic endodontics. The use of orascopy in conventional and surgical endodontic treatments has enabled the endodontist to become more discerning about the endodontic aetiology and the treatment procedures.

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